REMARKS

Claims 1 to 9 are pending in this application of which claim 1 is independent.[1] Favorable reconsideration and further examination are respectfully requested.

The examiner has reasserted his rejection of claims 1 to 9 under 35 USC 103 over U.S. Patent Application No. 2003/0069493 (Pan) in view of U.S. Patent Application No. 2004/0181146 (Yarnykh).[2] In this regard, the examiner states:

> With respect to Applicants' argument regarding the rejection claim 1, the applicant asserts that "Yarnykh teaches in the strongest possible terms that one should not acquire data from more than one slice following each DIR pulse module" (page 3). This means that Yarnykh had prior knowledge of acquiring data from more than one slice following each (singular) DIR pulse module.[3]

As shown above, claim 1 has been amended to recite that the at least two DIR preparation pulse modules occur within "a repetition time interval for a slice." In view of this amendment, withdrawal of the §103 rejection is respectfully requested. Applicants believe that the present invention is directed at a combination of elements that (1) went against the teachings of the prior art and (2) produced "new and unexpected results" relative to the prior art.

The MPEP states:

> A prima facie case of obviousness may also be rebutted by showing that the art, in any material respect, teaches away from the claimed invention. In re Geisler, 116 F.3d 1465, 1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997).[4]

> Applicant can rebut a presumption of obviousness based on a claimed invention that falls within a prior art range by showing "(1) [t]hat the prior art taught away from the claimed invention...or (2) that there are new and unexpected results relative to the prior art." Iron Grip Barbell Co., Inc. v. USA Sports, Inc., 392 F.3d 1317, 1322, 73 USPQ2d 1225, 1228 (Fed. Cir. 2004)[5]

Accordingly, the examiner is urged to reconsider and withdraw the rejection.

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[1] The Examiner is urged to independently confirm this recitation of the pending claims.
[2] Paragraph 2 of Office Action.
[3] Paragraph 1 of Office Action.
[4] MPEP 2144.05, section III, paragraph 2.
[5] MPEP 2144.05, section III, paragraph 3.

I. Prior Art Taught Away From The Claimed Invention

Amended claim 1 recites:

> administering a series of DIR preparation pulse modules at a repetition interval short enough that at least two DIR preparation pulse modules occur within a repetition time interval for a slice;
>
> in the interval between each DIR preparation pulse module, acquiring image data for a plurality of slices;

Neither Pan nor Yarnykh, alone or in combination, describe or suggest the foregoing features of claim 1. In fact, Yarnykh teaches away from the claimed features.

In Pan, a preparation sequence (e.g., a non-selective inversion pulse followed by a slice-selective re-inversion pulse) is triggered by the start of the R-R interval, following which MR data is acquired by fast spin echo readout for each slice in a slab when the signal from black blood is near a null point.[6] As the examiner suggests, Pan does not teach "performing more than one dual inversion recovery sequence within a single R-R interval."[7] This is because, in Pan, data acquisition occurs during mid-diastole and as such, an appropriate inversion time TI must be selected such that "the null point of the blood occurs in the middle of the multi-slice acquisition segment."[8]

In Yarnykh, even though a slab-selective inversion pulse is administered to reinvert an entire slab that includes a plurality of slices, a single slice is selected from the slab for imaging between two DIR pulse modules:

> In this method, the selective inversion RF pulse simultaneously inverts a magnetization for all of the plurality of slices that are to be imaged at the site within the predefined repetition time. After waiting a predefined inversion time or TI, which is calculated as a function of a number of slices to be imaged at the site, a sequence of RF pulses and magnetic field gradient pulses is executed to read out a signal for imaging a selected single slice from the plurality of slices. Then, after a predefined delay time that is also calculated as a function of the number of slices to be imaged, these steps are repeated to image each of the plurality of slices in succession.[9]

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[6] Fig. 2, paragraph [0008], lines 1-9, and paragraph [0025], lines 1-6.
[7] Page 3, lines 11-13 of Office Action.
[8] Pan et. al., paragraph [0027], lines 2-5, and paragraph [0030], lines 5-8.
[9] Yarnykh et al., paragraph [0008], lines 4-14, and Fig. 1.

As explained above, each slice from the plurality of slices is independently imaged by repeating the steps of administering a DIR pulse module and imaging the selected slice. This is because, in Yarnykh, imaging is performed for each slice only when the magnetization for the inflowing blood is at a zero-crossing point. In order to achieve faster imaging, the DIR pulse modules are located close to each other thus reducing the inversion time (TI) for nulling the blood signal.

Yarkykh further states:

> It is worth noting that comparable time efficiency is technically unachievable while using prior art methods. For instance, the eight-slice implementation of the method of Song et al. with 12 echoes in a train and the shortest available echo spacing (about 7 ms) would result in about 700 ms delay between an acquisition of the first and last slice, leading to consideration relaxation of the blood signal (.e., deviation from the zero crossing point) by the time the last slices are imaged.[10]

As suggested above, Yarnykh teaches in the strongest possible terms against acquiring slices at times other than when the inflowing blood magnetization is at the zero crossing point because there is "considerable relaxation of the blood signal by the time the last slices are imaged." As such, Yarnykh teaches that only a single slice must be imaged between DIR modules when contribution to the signal from flowing blood is substantially zero. Accordingly, one of ordinary skill in the art will conclude that Pan or Yarnykh, alone or in combination, teaches away from the present invention.

The Office Action states that Yarnykh's teaching away from imaging more than one slice between DIR modules constitutes that Yarknykh had prior knowledge of acquiring data from more than one slice following each DIR pulse module. This is completely contrary to the law. As set forth above, the MPEP clearly states that a case of obviousness may be rebutted by showing that the art teaches away from the invention. This is a textbook case of the art teaching away from the claimed invention. Accordingly, Applicants respectfully request that the examiner withdraw the 103 rejection.

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[10] Yarnykh et al., paragraph [0006], lines 8-14, and paragraph [0007], lines 1-8.

II. New And Unexpected Results Relative To The Prior Art

The features recited in claim 1 above produce new and unexpected results that are not anticipated or suggested by the combination of Pan and Yarnykh.

Yarnykh's teaching against acquisition of slices at times other than when the inflowing blood magnetization is nulled is analyzed in the background and summary section of the present application. Further, the summary section of the present application states:

> We have discovered that significantly faster image acquisition can be achieved with DIR imaging of blood vessels by administering a series of DIR preparation pulse modules at a repetition interval short enough that at least two DIR preparation pulse modules generally occur within each RR interval, and by acquiring image data for a plurality of slices following each DIR module. Acquiring image data for a plurality of slices means that image data is acquired at times other than when blood magnetization is perfectly nulled (at exactly TIo), but our research has established that the resulting images have acceptable image quality. [1]

As described above, notwithstanding the teaching of Yarnykh, image data for a plurality of slices between DIR modules is acquired at times other than when blood magnetization is nulled. In this regard, Applicants' research has established that the resulting images are acquired faster than prior art techniques and have acceptable image quality. Accordingly, one of ordinary skill would conclude that the combination of the elements recited in claim 1 of the present application produced new and unexpected results that were not anticipated or suggested by the combination of the prior art references.

In view of the foregoing remarks and evidence, Applicants respectfully submit that the application is in condition for allowance, and such action is respectfully requested at the examiner's earliest convenience.

Each of the dependent claims is also believed to define patentable features of the invention. Each dependent claim partakes of the novelty of its corresponding independent claim and, as such, has not been addressed specifically herein.

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or

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[1] Page 3, lines 1-9.

concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed.

Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is in condition for allowance, and such action is respectfully requested at the Examiner's earliest convenience.

Enclosed is a Notice of Appeal and a Petition for Three Month Extension of Time. The fees in the amount of $500 and $1020 are being paid concurrently on the Electronic Filing System (EFS) by way of Deposit Account authorization. Please apply any other required fees to deposit account 06-1050, referencing the attorney docket number shown above.

Respectfully submitted,

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Paul A. Pysher
Attorney for Applicants
Reg. No. 40,780

PTO Customer No. 26161
Fish & Richardson P.C.
Telephone: (617) 542-5070
Facsimile: (617) 542-8906